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Author(s): M. L., Eda Vidali and C. C. Lamberg-Karlovsky
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PREHISTORIC SETTLEMENT PATTERNS AROUND TEPE YAHYA: A QUANTITATIVE ANALYSIS*

M. L. and EDA VIDALI and C. C. LAMBERG-KARLOVSKY, Peabody Museum, Harvard University

INTRODUCTION

TEPE Yahya is a prehistoric mound in southeastern Iran which has been investigated for the past several years. Following its discovery and initial survey in 1967, five full seasons of excavation have been conducted to date. As part of the research program for the 1973 season, a study was undertaken of the feasibility of uncovering evidence of habitation in the area adjacent to the site by means of a statistical survey of sherd distribution.

Tepe Yahya is a symmetrical mound, approximately 20 meters in height. It has the form of a truncated cone whose diameter measures roughly 180 meters at the base and about 40 meters at the top. Its geographic coordinates are 28° 20′ north latitude and 58° 50′ east longitude, or about 225 kilometers directly south of the city of Kerman and 30 kilometers northeast of the town of Dowlatabad. The mound is situated in a mountain valley, the Soghun Valley, whose elevation is close to 1,500 meters above sea level and whose dimensions are approximately 20 kilometers in length and 10 kilometers in width. The tepe constitutes the dominant feature within the valley, by virtue of both its height and its isolated position. It lies along the valley's central axis and toward its southern end, where the Soghun Valley descends toward the Dowlatabad plain.

The geomorphology of the Soghun Valley was studied during the 1973 season by R. Snead and P. Durgin and a detailed report of their findings will be published. For our purposes, suffice it to say that the region surrounding the mound is characterized by the virtual absence of trees or heavy brush. The area in the immediate vicinity of the tepe is lightly cultivated and is crossed by a dry river bed and by deep gullies carved into the soft sediments by the action of floodwater. The hamlet of Baghan lies a few hundred meters south of the tepe.

Previous seasons of excavation revealed that Tepe Yahya was inhabited over a time span of some five millennia, from roughly the middle of the fifth millennium B.C. to the second half of the first millennium A.D. With the exception of a notable gap throughout most of the second millennium, the site appears to have been continuously occupied. The following periods of occupation have thus far been distinguished at Tepe Yahya:

Period VI:	4500–3800 B.C.
Period V A–C:	3800–3400 B.C.

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Period IV C:	3400–3000 B.C.
Period IV B:	3000–2500 B.C.
Gap?	
Period IV A:	2100–1800 B.C.
Gap	
Period III:	750–500 B.C.
Period II A&B:	500 B.C.–200 A.D.
Period I A&B:	200–700 A.D.

OBJECTIVE

The objective of the present program was to arrive at a quantitative estimate of the pattern of sherd distribution within the area immediately adjacent to the mound. Accordingly, we had to establish (1) whether sherds collected from the surface in the manner to be described can serve as quantitative indexes of sherd density below the surface of the soil, and (2) whether such surface sherds lend themselves to accurate dating in terms of chronological period. Since the validity of this whole exercise hinges largely on the latter consideration, we shall address ourselves to it first.

SHERD CHRONOLOGY

The sorting of sherds according to period was performed exclusively by Lamberg-Karlovsky who has directed the excavations at Tepe Yahya from their inception and has extensive and critical knowledge of all pottery types occurring in the Soghun Valley. To minimize possible biases, Lamberg-Karlovsky did not personally participate in the task of sherd collection and was presented with assemblages of sherds coded in such a manner that he had no way of inferring their origin. The sherds gathered in the course of our survey were typically small body sherds, badly eroded, almost totally devoid of distinctive or diagnostic features (painted designs, incised decoration, portions of rims or bases). Yet notwithstanding their nondescript and ambiguous nature, Lamberg-Karlovsky was able to assign all but 28 percent of these sherds to the various chronological periods. Moreover, he felt fairly confident that the majority of those sherds which could not be categorized by period probably belong to the last phases of Tepe Yahya's history.

To check the accuracy of Lamberg-Karlovsky's sherd sorting skill, the following two tests were performed. In order to rate the consistency of his selection criteria, a random sample of the sherds which he had already classified were recoded and resubmitted to Lamberg-Karlovsky for sorting after an interval of about a month. The test-retest results are compared in table 1. Out of a total of 65 test sherds, 53 were classified by Lamberg-Karlovsky in an identical manner on both occasions. The remaining 12 were assigned to different chronological periods on the second as compared with the initial sorting. However, 6 of these mismatches represent a shift of but one chronological interval (i.e., to either the immediately preceding or subsequent period) which, in view of the continuity of certain pottery types across periods, need not signify lack of consistency. Were we to discard these latter instances as ambiguous, Lamberg-Karlovsky's reliability score would be 91 percent, while by invoking a more stringent requirement and counting only identical matches, his consistency rating is still an impressive 82 percent.

Having demonstrated to our satisfaction the high degree of reliability or repeata-

TABLE 1

RELIABILITY CHECK ON SHERD SORTING CRITERIA

SECOND SORTING

FIRST SORTING	PERIOD	VI	V	IVC	IVB	IVA	III, II	I	?	FIRST SORTING
	VI									
	V		7					1		8
	IVC									
	IVB				6					6
	IVA					14	1	3		18
	III, II				2	1	8	2		13
	I							8		8
	?								10	10
			7		8	15	9	14	10	TOTALS

SECOND SORTING

NOTE: The same sample of surface sherds was sorted by chronological period on two separate occasions. The discrepancy between the first and second sorting by period can be seen in the totals column.

bility of Lamberg-Karlovsky's sherd sorting criteria, a question still remains as to their validity or correctness. That is, no matter how consistent, how well does the assignment of surface sherds to specific time periods reflect the chronological division within the mound? To shed some light on this issue, a second test was devised. This involved collecting sherds from the mound itself from the various archaeological strata whose chronology had previously been defined and documented. The test sherds in this instance were not chosen at random since care was taken to select only body sherds lacking obvious diagnostic features and comparable both in size and wear with sherds collected in surface

TABLE 2

VALIDITY CHECK OF SHERD SORTING CRITERIA

PERIOD	VI	V	IVC	IVB	IVA	III, II	I	?
VI	4							
V	3	8			1	1		
IVC								
IVB				3				
IVA								
III, II					7	12		
I						1	4	
?								

NOTE: The classification of sherds from different archaeological strata was compared with their actual provenance within the mound.

surveys. After coding them as to place of origin, this new set of test sherds was presented to Lamberg-Karlovsky for sorting.

The results are shown in table 2. It is worth noting that in this second test, all sherds were allocated to a definite period and none was placed in the unclassifiable category. Thirty-one sherds (or 67 percent) out of a total of 44 were unambiguously assigned to the correct strata while four were incorrectly classified. (One of these latter sherds was most likely a contaminant that did not belong to the chronological stratum where it was found.) An area of ambiguity surrounds the classification of the remaining 11 sherds for which the time period assigned was off by one chronological interval—a result that is understandable, indeed virtually unavoidable, given the continuity of certain wares. Were we to set aside these equivocal attributions, the proportion of stratified sherds correctly categorized by chronological stratum would be more than 90 percent.

In summary, the evidence of these two control tests (which regrettably were not sufficiently exhaustive) warrants the conclusion that Lamberg-Karlovsky's classification of nondistinct, nondescript sherds by time period shows a satisfactory level of accuracy. Correlation coefficients (r) computed for each set of test results are positive and high; for the test-retest performance (see table 1) r is 0.89, while for the matching of time periods and archaeological strata (table 2) r is 0.92. We therefore feel justified in claiming that a statistical survey of surface sherd distribution by chronological period is feasible within the area of the Soghun Valley which has been studied by Lamberg-Karlovsky and his associates in recent years. Lamberg-Karlovsky's ability to correctly classify surface ceramics around Tepe Yahya undoubtedly stems from the fact that he has processed *every* sherd from the excavations. At Tepe Yahya all sherds are collected from the excavations and processed by Lamberg-Karlovsky for registration, selection for quantitative studies, photography, and physico-chemical analyses. This has assured continuity in all of the above and provided him an intimate awareness of the ceramics at Tepe Yahya.

SURFACE/SUBSURFACE COMPARISONS

Before assessing the data of our statistical survey, we must examine the relation of surface sherd density to that obtaining below the surface. While our aim was to determine the pattern of sherd distribution within a radius of 500 meters or so around Tepe Yahya, in practice we had to confine ourselves to sampling the density of sherds *above* the surface. It therefore behooves us to establish whether the distribution of sherds observed above ground is indicative of the subsurface sherd distribution. This involves a determination of such quantities as the following: (1) the relative weight of surface and subsurface sherds; (2) the ratio of the number of surface to subsurface sherds per unit area; (3) the relative frequency of sherds of each chronological period above and below the surface.

It goes without saying that the lack of such comparative data severely limits the inferences to be drawn solely on the basis of surface collection. We may cite two sample surveys conducted on the surface of Tepe Yahya itself. Surface sherds were collected from two portions of the mound apparently uncontaminated by excavation debris: a 9 m^2 area at the very top of the mound and a 4.5 m^2 area on the eastern slope near the valley floor. The number of sherds found at each location and their classification by period are shown in table 3. These figures are consistent with but one interpretation:

TABLE 3

CLASSIFICATION BY CHRONOLOGICAL PERIOD OF SHERDS FROM TWO LOCATIONS ON THE SURFACE OF TEPE YAHYA

	NUMBER OF SHERDS	
PERIOD	TOP OF MOUND	EASTERN SLOPE
VI	0	1
V	3	3
IVC	0	0
IVB	0	1
IVA	4	14
III, II, 1	78	131
?	27	6

most surface sherds collected from Tepe Yahya belong to the later periods of its occupation.

But consider the following factors. Tepe Yahya, as mentioned, was inhabited almost continuously from the fifth millennium through the Sasanian era. Current excavations indicate that nearly nine-tenths of the total volume of the mound can be attributed to pre-Achaemenean times, or more precisely, to the span from the mid-fifth to the early second millennium (Periods VI, V, and IV). Following its abandonment during the second millennium, the site was reoccupied and the later phases of its habitation (Periods III, II, and I) contributed little more than one-tenth of the present volume of the mound. Yet on the basis of the surface sherd data reported in table 3, one would not guess that Tepe Yahya represents primarily a third, fourth, and fifth millennium site.

With this much of a caveat against conclusions derived from uncontrolled data, we now turn to our comparative evaluation of sherd distributions at and below the surface. At 7 representative spots within the survey area, direct comparisons of the surface and subsurface sherd densities were carried out. At each of these locations, a 9 m^2 square was marked off, and all surface sherds within it were collected. Next, a small trench was dug within each square to a depth at which no more sherds were to be found; this usually occurred at about 50 cm. The sherds in the surface and subsurface samples were separately counted, weighed, and sorted as to chronological period.

In general, sherds found on the surface are heavier, hence larger, than those buried in the soil. The average weight of surface sherds (16.2 gm) is roughly double the weight of subsurface sherds (7.7 gm). This finding is in accord with what one might predict from the geometry of the situation: given an assemblage of sherds—similar in shape but differing in size—randomly distributed throughout a volume of soil, the likelihood that any particular sherd will pierce the surface is directly proportional to its linear dimensions. Hence our observed phenomenon that, on the average, sherds that surface are larger than those in the ground.

In the open fields around Tepe Yahya, most of which show signs of past or recent cultivation, sherds are found in considerable numbers down to a depth of about 50 cm., which probably represents the level reached by animal-drawn plows. We next need to examine the relationship of surface to subsurface sherd density, that is, to compute the ratio of the absolute number of sherds per unit area for each of our surface/subsurface probes. Only if that ratio proves reasonably constant for the seven test sites spotted

TABLE 4

RELATIONSHIP OF SURFACE AND SUBSURFACE SHERD DENSITY

	SUBSURFACE SAMPLES			SURFACE SAMPLES			RATIO OF SUBSURFACE TO SURFACE SHERD DENSITY 3/6
	AREA SAMPLED 1	NUMBER OF SHERDS 2	SHERD DENSITY 3 = 2/1	AREA SAMPLED 4	NUMBER OF SHERDS 5	SHERD DENSITY 6 = 5/4	
	0.25 m^3	31	124	9 m^2	31	3.4	36
	1.1	66	60	9	16	1.8	34
	0.9	49	54	9	17	1.9	29
	0.75	55	73	9	28	3.1	24
	0.7	114	163	9	58	6.4	25
	0.55	47	85	9	10	1.1	77
	0.6	12	20	9	7	0.8	26
TOTAL	4.85	374		63	167		

Ratio of Subsurface to Surface Sherd Density

$$\text{Weighted Average} = \frac{374/4.85}{167/63} = 29$$

around our survey area are we entitled to treat surface observations of sherd density as indicative of the density of sherds within the entire region sampled. The relevant data, as presented in table 4, reveal that, save in one instance, the ratio of subsurface to surface sherd density is approximately constant; for 6 of the 7 test sites, it ranges between 24 and 36, while for the exceptional case it attains a value of 77. The weighted average of the seven ratios is 29, which means that that is the factor by which surface observations must be multiplied to convert them to corresponding subsurface density values.

The relative frequency of sherds of various time periods found in our surface/subsurface comparisons appears in table 5. This table lists the percentage distribution of sherds by chronological period for the pooled surface and subsurface sites, respectively. We were interested in determining whether the two distributions would be substantially similar or markedly different. The former outcome would be expected if—as a result of cultiva-

TABLE 5

PERCENTAGE DISTRIBUTION OF SHERDS BY CHRONOLOGICAL PERIOD OF SEVEN SURFACE AND SEVEN SUBSURFACE SAMPLES

PERIOD	SURFACE	SUBSURFACE
VI	1%	0%
V	5	12
IVC	0	0
IVB	1	0
IVA	29	30
III, II, I	42 } 64	25 } 58
?	22	33

tion, for instance—there had been over time a more-or-less uniform mixing or "homogenization" of sherds of all periods both above and below the surface; by contrast, a disproportionately high representation of later sherds on the surface as compared to the subsurface could only result from incomplete mixing.

We were only partially successful in achieving our aim since our pairs of test sites turned out to be too few in number and too small in area to yield sufficient data for conclusive intercomparisons of sherd distributions for the earlier chronological periods. For Period IV A and the "Later" periods (III, II, and I combined), sample sizes were large enough for meaningful comparisons of surface and subsurface data and for these periods the percentages of sherds found on the surface and below are quite similar. This leads us to infer that from Period IV A onward at least, sherds have been turned over and churned over so as to be dispersed uniformly throughout the top soil; hence their distribution on the surface is proportional to their subsurface density pattern. By extension, we venture to suggest that comparable dispersion has occurred for sherds of the earlier periods whose time span for mixing has been correspondingly longer.

SURFACE SURVEY

The overall goal of this study was to construct a density map of surface sherds found in the Soghun Valley within a radius of approximately 500 meters around Tepe Yahya. Considerable care was taken to guarantee the statistical soundness of the survey and, in particular, to guard against the danger that the selection of sample sites be influenced by the visible presence or absence of sherds. To that end, samples were gathered at consecutive 50 meter intervals along lines radiating outward from the mound. At each 50 meter mark, a 3 × 3 meter square was delimited by driving four spikes into the ground and wrapping a string around them. Within each 9 m² surface, all sherds resting on the ground or visible without scraping the soil were collected and bagged. Sherds whose maximum dimension was less than 1.5 cm were excluded, as were sherds so badly

TABLE 6

NUMBER OF SURFACE SHERDS COLLECTED AT EACH SAMPLE SITE

COMPASS BEARINGS FROM TEPE YAHYA	DISTANCE IN METERS FROM CENTER OF TEPE YAHYA											
	150	200	250	300	350	400	450	500	550	600	650	700
0°	2	3	2	2	6	6	4					
25°	0	2	4	14	7	7	6	9				
50°	6	10	12	7	5	7	7	3				
72°	5	6	3	14	35	21	9	1				
110°	5	2	11	6	1	4	0	—				
140°	4	0	—	—	1	4	6	3				
230°	47	44	14	10	46	42	46	60	14	77	10	2
250°	7	14	12	21	30	30	32	39				
270°	13	9	22	10	9	42	24	—				
290°	—	15	25	5	14	—	—	—				
310°	18	5	9	9	37	54	0	14	9	4	8	
330°	—	0	7	3	4	3	6	—				

pitted or eroded that none of the original finish remained. Any residual ambiguities in the selection process were further minimized by having a single individual undertake the collecting of all sherds. Data analysis was commenced only after completion of the entire survey so that our objectivity might not be compromised by the unwitting influence of preconceived notions derived from preliminary findings.

The survey proper consisted of twelve runs radiating out from Tepe Yahya along the following compass bearings: 0°, 25°, 50°, 72°, 110°, 140°, 230°, 250°, 270°, 290°, 310°, and 330°. The presence of the modern village of Baghan and of wide gullies formed by a local stream precluded sampling the sector 140°–230°. In order to avoid surface contamination resulting from excavation dumps, a road running west of the tepe, and gullies to the south and west, the starting point for all radial runs was at 150 meters from the center of the mound (or approximately 50 meters from its base), with subsequent points along each run usually being sampled every 50 meters as described above. A mapping of these sample sites is shown in figure 1, while table 6 lists the number of sherds collected in the course of the survey. Each of these sherds was individually coded and submitted

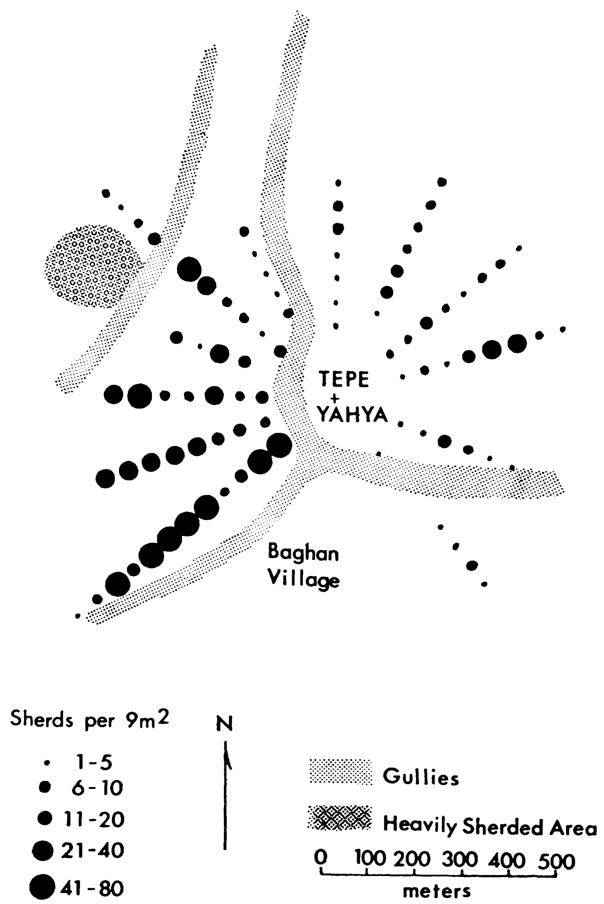

FIG. 1.—Density map of surface sherds around Tepe Yahya

TABLE 7

CLASSIFICATION BY CHRONOLOGICAL PERIOD OF SURFACE SHERDS ALONG EACH OF 12 RADIAL RUNS FROM TEPE YAHYA

COMPASS BEARING FROM TEPE YAHYA	CHRONOLOGICAL PERIOD									
	VI	V	IVC	IVB	IVA	III, II	I	Islamic	?	Total
0°		1			12		6	1	5	25
25°		1			17	2	16	1	19	56
50°		1			27	3	13	1	12	57
72°	1	13	1		35	8	9		27	94
110°		1			9		4		15	29
140°				1	4		9		4	18
230°	1	15		3	115	50	112		116	412
250°		4	1	1	52	8	69	5	45	185
270°		5		2	42	16	39		35	139
290°		5		2	20	1	18		13	59
310°	4	14		2	49	29	16		58	167
330°		1			10	1	6		5	23
Total	6	61	2	11	392	113	317	8	354	1264

to Lamberg-Karlovsky for sorting as to its probable chronological origin; the results are summarized in table 7.

While these findings constitute our basic raw data, they were supplemented by an additional set of observations. On the outer limit of our survey area, at approximately 500 meters from Tepe Yahya in a northwesterly direction (compass bearing 300°), there is a heavily sherded region extending over an area of more than two hectares. A separate survey of this area was undertaken in which surface sherds were collected, at 50 meter intervals, from thirteen 3 × 3 meter sample squares. Table 8 lists the frequency and percentage of sherds of various periods recovered from this heavily sherded site.

DISCUSSION

Tepe Yahya rises as an isolated landmark from the flat plain of the Soghun Valley. Step-trenches on both its northern and southern flanks have exposed layer upon layer

TABLE 8

NUMBER AND PERCENTAGE OF SHERDS FROM SURFACE OF HEAVILY SHERDED LOCALE

PERIOD	NUMBER OF SHERDS		PERCENTAGE OF TOTAL
VI	0		0
V	199		20
IVC	1		0
IVB	10		1
IVA	174		17
III, II	28	629	62
I	308		
Islamic	1		
?	292		
Total	1013		100

of occupation levels. The earliest town (Period VI, fifth millennium) appears to have extended over the full area at the base of the mound, or over approximately 20,000 m^2. Later building levels superimposed above it inevitably covered progressively smaller areas since the mound tapers upward with a slope ranging from 20° near the base to 35° close to the summit; the Sasanian citadel which crowned the top encompassed an area of only some 2,000 m^2.

It might be posited that the original steepness of the slope has been reduced by erosion which would tend to shrink the upper and enlarge the lower cross-sectional area of the tepe. And, in fact, all upper building levels have walls flying off into space, confirming the downward slide of the outer skin of the mound. The effect of erosion, however, cannot have been overwhelming. Lacking retaining walls of stone or fired brick, the mound is unlikely to have had slopes of steepness in excess of the angle of repose[1] of clay, which at Tepe Yahya is about 36°. Furthermore if erosion or earth slides had altered substantially the contours of Tepe Yahya, large quantities of debris would have accumulated at the base of the mound. While such debris is observed, it is not present in sufficient amount to argue for a catastrophic collapse of the slopes.

We conclude that the successive inhabitants of Tepe Yahya had an increasingly smaller surface area at their disposal. Given the steepness of the mound, it is unlikely that its slopes provided additional building space or *Lebensraum*.

As the superimposed settlements at Tepe Yahya diminished in size, condemned by the inexorable laws of mound construction, did their populations decline correspondingly, or did they spill over onto the surrounding plain? We would like to pursue the hypothesis that the latter may well have been the situation. That brings us to the next question: if at certain times, part of the population lived off-mound, can we adduce evidence as to the nature of their settlement patterns? An obvious one would have been to enlarge the perimeter of the existing settlement by shifting to the valley floor and occupying the region in the immediate vicinity of the tepe. In that event, one would expect signs of habitation to be most concentrated in the plain adjacent to the mound and to taper off as one moves away from it. Such appears not to have been the case, judging from the distribution of surface sherds. Sherd density averaged over all 12 radial runs and plotted as a function of distance from the mound (see fig. 2) remains relatively constant; if anything, it seems to increase with distance, suggesting that the off-mound inhabitants were rather uniformly dispersed throughout the area of our survey.

But during which of Tepe Yahya's chronological periods did such off-mound habitation and dispersion occur? We shall attempt an answer to this question by advancing the following line of reasoning. Let us assume that the number of sherds per unit volume within the mound is, to a first approximation, constant throughout. (While this assumption has not been verified experimentally—and, indeed, would be difficult to prove since less than 4 percent of the mound has been excavated to date, it represents the considered judgment of the Project Director.) It then follows that the percentage of sherds of each chronological period within the mound should be roughly proportional to the percentage of the mound's volume attributable to that period. The fraction of the total volume corresponding to each chronological period is, in principle, a straightforward calculation; the requisite data are strata thickness and the cross-sectional area of the

[1] The angle of repose is the maximum inclination of a slope at which unconsolidated material is stable.

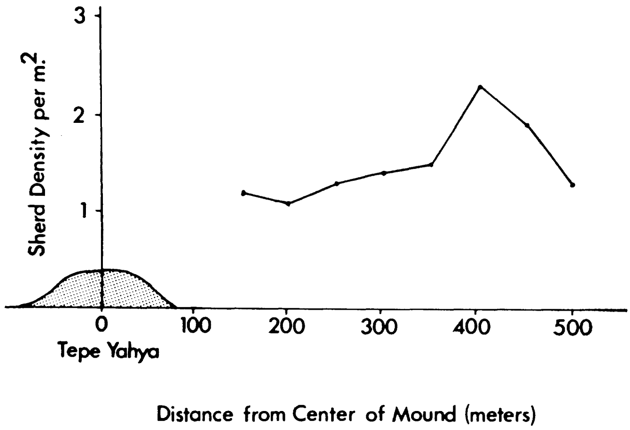

FIG. 2.—Surface sherd density as a function of distance from Tepe Yahya

mound at the height of each stratum. In practice, this determination proved not so simple because the anatomy of the mound turned out to be complex. At Tepe Yahya, the depth of deposition of each of the periods can be seen at three different locations: the north step-trench, the south step-trench, and a deep sounding in the center of the mound which though not reaching virgin soil has reached Period VI strata. The schematic profiles (see fig. 3) display notable stratigraphic disparities; there are variable depths of deposition of similar periods in different locations. Consequently, in computing the proportion of the mound's volume associated with a given time period, the average of the three measures of stratum thickness was used; this value is clearly more representative than that obtained from a single sounding and extrapolated to the rest of the mound. The percentage distribution of sherds within the mound derived from these volumetric relations appears in table 9, as do the corresponding percentages actually observed in our surface survey outside the mound.

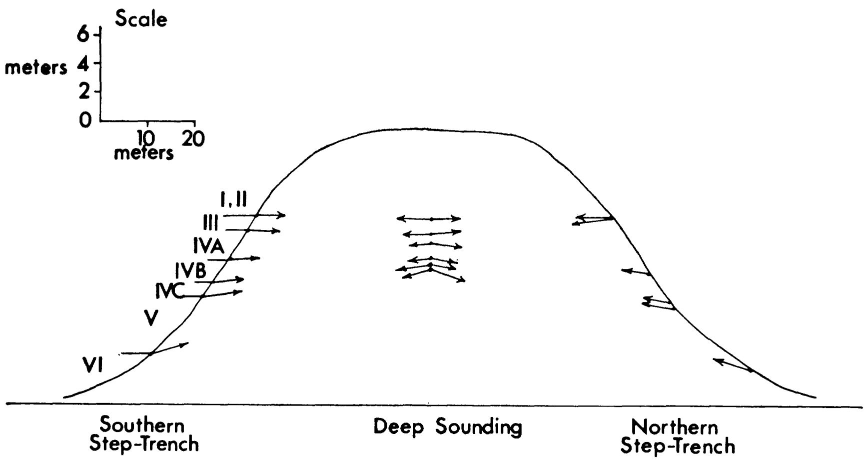

FIG. 3.—Schematic view of stratigraphy of Tepe Yahya

TABLE 9

DISTRIBUTION OF SHERDS BY CHRONOLOGICAL PERIOD WITHIN THE MOUND AND OFF-MOUND

PERIOD	PERCENTAGE WITHIN MOUND	PERCENTAGE OFF-MOUND
VI	54	0.5
V	16	5
IVC	3	0.2
IVB	6	0.8
IVA	8	31
III, II, I	12	34.5 } 63
?	0	28 } 63

There are obvious discrepancies between these two columns of figures. The overwhelming majority (94 percent) of the sherds found off-mound belong to Period IV A and to the later periods. Sherds of Period VI which are estimated to amount to about half (54 percent) of the total within the tepe are exceedingly rare in the surrounding plain (0.5 percent). The relative proportions of Period V sherds fall between these extremes (16 percent on-mound versus 5 percent off-mound).

These findings lend themselves to the following interpretation. During Period VI, the inhabitants of the lower Soghun Valley lived clustered in the fifth millennium town of Tepe Yahya. They tended flocks of sheep and goats, had domesticated cattle, and cultivated the surrounding fields with emmer, barley, peas, and lentils, leaving traces of their transit across the valley floor in the form of a light scatter of pottery sherds.[2]

Period V coincides with increasing commerce, industry, and the arts. There is a marked increase in imported goods (items of obsidian, turquoise, carnelian, alabaster), metal tools make their appearance, steatite objects (bowls and beads) are produced in quantity, as are painted ceramics of fine quality. During this period we detect evidence of off-mound settlement—light in the overall area around the tepe, denser in the heavily sherded location 500 meters northwest of the mound.

Habitation seems to have been confined to the mound again during Periods IV C and IV B for which the sherd count was very scanty within the entire area surveyed, including the locale at its periphery where sherds of the preceding period were quite abundant.

The subsequent periods show signs of a renewed shift from on-mound to off-mound settlement. From Period IV A onward, the relative percentages of sherds associated with given chronological strata become larger in the plain than on the tepe. It would appear that IV A people spilled over from the mound onto the surrounding valley floor and that they did so to a greater degree than their Period V ancestors; they apparently also resumed settlement on the heavily sherded spot to the northwest where occupation had first been evident during Period V times. This pattern persists during subsequent periods (III, II, and I). In all probability, by Sasanian times Tepe Yahya, while still the political center of the region, had become primarily a military or administrative head-

[2] Our paleofaunal analyses are being undertaken by Richard Meadow; analysis of seeds from excavations and flotation programs are being studied by M. Constantini, while the report of pollen cores taken from the mound and the Pleistocene lake bed in the Soghun Valley have been completed by Abraham Solomon. C–14 dates and Del C–13 values for calcareous tufa indicate a more recent drying of the lake than expected, toward the end of the sixth millennium.

quarters; the common people no longer made their homes on what, by this time, had become an inconveniently steep mound.

With the advent of Islam, the archaeological record of Tepe Yahya and its immediate environs comes to an end. Sherds of the Muslim era are virtually absent at this end of the valley, though several Islamic sites—notably Dasht-i Deh—have been discovered at some distance up-valley from Tepe Yahya. Thus with the cessation of habitation on and around Tepe Yahya in the second half of the first millennium A.D., the population seems to have shifted to other sites in the Soghun Valley.

The foregoing conclusions emerge from the converging evidence of two distinct but complementary archaeological approaches, namely systematic excavation and statistical survey. Neither the stratigraphic and typological information uncovered by the former nor the quantitative data generated by the latter method would by themselves have sufficed to reveal the evolution of settlement patterns. Yet by virtue of a collaborative effort that proved as fruitful as it was essential, we have gained greater insight into the macrostructure of prehistoric population shifts around Tepe Yahya.

ADDENDUM

Since the completion of this paper in 1973, we have completed an intensive foot survey of the Soghun Valley in order to determine local settlement patterns associated with the different periods of occupation at Tepe Yahya. The excavations of 38 cairn burials and the recording of several hundred others throughout the valley were undertaken by Mr. William Fitz. The settlement survey was undertaken by Mr. Thomas Beale. We briefly summarize their important results.

The excavation of the cairn burials provided a corpus of poorly manufactured complete pots, occasional ornaments of bronze, and fractional burials. The different architecture of the cairns and associated remains will be the subject of a separate paper. The materials from all the cairn burials can be paralleled with the corpus recovered from Periods I and II at Tepe Yahya.

In the Soghun Valley, Thomas Beale recorded a total of 21 small mounds and 20 surface sites. Overall, the survey revealed dramatic changes in the distribution of sites in successive periods accompanied by some major fluctuations in the population of the valley through time.

No sites were discovered that could definitely be dated to the earliest settlement at Tepe Yahya (characterized by 100 percent coarse-chaff tempered ware). Evidently the initial phase of settlement in the valley was restricted to Yahya itself. The absence of early sites contrasts with the Dolatabad Valley, 30 kilometers west of Tepe Yahya, where Martha Prickett's survey discovered twelve substantial Period VI mounds. The largest was 12 hectares. The Dolatabad area is some 450–500 meters lower than the Soghun Valley. Its center is a broad flat area of more than 15–27 kilometers.

The first settlements off the mound at Yahya appear early in the fourth millennium as a series of surface sites dating to Yahya Periods VB and IVC. All the sites are situated on alluvial gravels or low hillocks at the edges of the valley: 6 in the southwest corner of the valley in the vicinity of Yahya and 2 in the valley's south end near natural springs. These sites appear to have been badly eroded, leaving only a dense scatter of surface sherds overlying less than 50 cm of deposit. The largest of these sites (Period VB, VA,

and IVC?) covers almost 10 hectares and lies less than a kilometer from Yahya. A small percentage of the sherds collected on these sites, as well as from sites around Dolatabad have white and black paint on red ware. This ceramic type is entirely unknown from Tepe Yahya and probably indicates a period of occupation in the Soghun Valley between Periods VA and IVC.

The sparse Period V settlement in the Soghun Valley contrasts with the denser settlement about Dolatabad where Martha Prickett has recorded 23 sites of Period VB, 52 sites of VA and 27 sites between Yahya Periods VA and IVC. These sites average between 1.5 and 2.5 hectares, although a few are of 5 to 6 hectares. There is not a *single* recorded Period IVC, IVB, or IVA site in the entire Dolatabad Valley. One cannot refute this evidence which argues for a total population collapse around Dolatabad prior to the Period IVC Proto-Elamite settlement at Yahya. Settlement is re-established around Dolatabad only in the first millennium B.C. (Period II/III) with two sites. There are 40 identified Sasanian sites and 21 Islamic settlements.

Consequently, our understanding of the third millennium sequence (Periods IVC, IVB, and IVA) is derived entirely from the Soghun Valley. Very few sherds and no real sites were found off the mound of Yahya in Period IVB. The apparent low level of local population in the valley throughout the Proto-Elamite administrative complex of Period IVC and the extensive production of carved chlorite (steatite) bowls during Period IVB requires further understanding. It may be related to the abandonment of the Dolatabad Valley immediately before Period IVC.

The high density of Period IVA sherds noted above extends for up to 500 meters from Yahya in most directions. Significant concentrations of IVA pottery were found elsewhere in the valley. It would appear then that although there was a population buildup in this period, it centered around Yahya itself.

The abandonment of the mound in the first half of the second millennium B.C. seems to apply to the valley as a whole. When occupation resumes in the first half of the first millennium (Period III), a new demographic pattern emerges. The central and eastern portions of the valley are settled for the first time. Six mounds of Periods III through I were recorded in these areas. None of these mounds is over a hectare in extent. The proximity of these sites to ancient gabarbands suggests that this population shift was made possible by the introduction of new hydrological techniques.

Our excavations at Tepe Yahya have not recovered any evidence of Islamic occupation. The Islamic period in the valley from the ninth to fifteenth centuries A.D., however, represents the era of greatest population density. We have located 12 mounds of Islamic settlements. None of them exceed a hectare. The Islamic site of Dasht-i Deh, excavated for the Yahya Project by Andrew Williamson, lies at the south end of the valley. At the valley's far north end a sprawling agglomeration of low Islamic mounds covering 33 hectares was found. They are collectively known as Tepe Shīr Alī.

Excavations at Tepe Yahya and the related sondages on nearby sites, together with the intensive settlement survey in the Soghun and Dolatabad valleys are being prepared for final publication. Our data afford us a rare opportunity for studying the population structures, cultural processes and environmental conditions over several millennia in a previously poorly understood region of the Iranian Plateau.